

AD-A268 661



2

DOT/FAA/AM-93/10

Office of Aviation Medicine
Washington, D.C. 20591

Head and Face Anthropometry of Adult U.S. Civilians

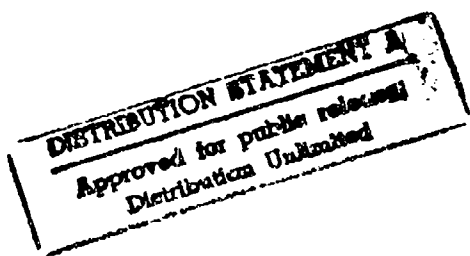
Joseph W. Young

Civil Aeromedical Institute
Federal Aviation Administration
Oklahoma City, Oklahoma 73125

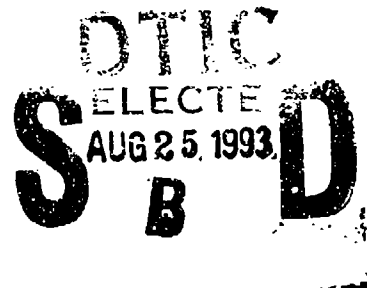
July 1993

Final Report

This document is available to the public
through the National Technical Information
Service, Springfield, Virginia 22161.



U.S. Department
of Transportation
Federal Aviation
Administration



93 8 24 07 3

NOTICE

This document is disseminated under the sponsorship of the U.S. Department of Transportation in the interest of information exchange. The United States Government assumes no liability for the contents or use thereof.

1. Report No. DOT/FAA/AM-93/10	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle Head and Face Anthropometry of Adult U.S. Citizens		5. Report Date July 1993	
		6. Performing Organization Code	
7. Author(s) Joseph W. Young		8. Performing Organization Report No.	
9. Performing Organization Name and Address FAA Civil Aeromedical Institute P.O. Box 25082 Oklahoma City, OK 73125		10. Work Unit No. (TRIS)	
		11. Contract or Grant No.	
12. Sponsoring Agency name and Address Office of Aviation Medicine Federal Aviation Administration 800 Independence Avenue, S.W. Washington, DC 20591		13. Type of Report and Period Covered	
		14. Sponsoring Agency Code	
15. Supplemental Notes Work was performed under Task AM-B-92-PRS-87 16.			
16. Abstract This report presents a total of 17 traditional and 5 new head and facial dimensions from a random, composite U.S. female and male civilian population measured over a period of 30 years. The 5 new measurements, identified to describe specific anatomical relationships of the face, can have a direct influence on equipment design concepts. The survey population includes 376 (195 females and 172 males) adult subjects in the age range of 17 through 69 years representing a predominantly high ratio of Caucasian subjects to other ethnic origin subjects. The data summary format is specifically intended for basic design concept use. These dimensions describe essential anatomical characteristics for use as basic design criteria in the development of protective equipment for the head and face. Because of the lack of standardization of anatomical and anthropometrical terminology, a thesaurus of selected anatomical and anthropometrical terms, specific to descriptive labels used in this report, is provided as a cross reference for anthropometrical dimensions.			
17. Key Words Anatomy, Anthropometry, Anatomical Characteristics, Head and Face Anthropometry		18. Distribution Statement Document is available to the public through the National Technical Information Service, Springfield, Virginia 22161.	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 44	22. Price

FOREWORD

This report presents a current CAMI data base of adult head and face anthropometry that will typically identify a generalized morphological diversity of the U. S. population. The initial data format and data for this CAMI data base was generated, in support of a North American Aviation, Inc. research and development program, to provide special design criteria for the protective helmets, protective breathing devices, and pressurized flight gear for advanced weapon systems. These data, which form a part of the CAMI/1992 data base, represent both traditional and new unique measurements.

The largest part of the CAMI data sample was obtained in support of long range research and development programs at the Civil Aeromedical Institute, Federal Aviation Administration, Department of Transportation, and related protective equipment industries. These data support past and ongoing CAMI joint research and evaluation programs with design criteria for face related protective equipment and identify the ranges of face morphology of test subjects for comparison with target populations.

DTIC QUALITY INSPECTED 8

Accession For	
NTIS GRA&I	<input checked="checked" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By _____	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A-1	

TABLE OF CONTENTS

INTRODUCTION	1
ANTHROPOMETRIC DATA BASES	1
STATISTICAL DESCRIPTION	6
DEFINITIONS OF ANATOMICAL LANDMARKS AND PLANES	6
DEFINITIONS OF ANTHROPOMETRICAL MEASUREMENTS	12
REFERENCES	14
APPENDIX A ANTHROPOMETRY THESAURUS	A-1
APPENDIX B STATISTICAL SUMMARY TABLES	B-1

LIST OF FIGURES

FIGURE 1.	COMPARATIVE HEAD BREADTH PERCENTILES	3
FIGURE 2.	COMPARATIVE HEAD LENGTH PERCENTILES	3
FIGURE 3.	COMPARATIVE FACE BREADTH PERCENTILES	4
FIGURE 4.	COMPARATIVE FACE LENGTH PERCENTILES	4
FIGURE 5.	COMPARATIVE NOSE BREADTH PERCENTILES	5
FIGURE 6.	COMPARATIVE HEAD LENGTH PERCENTILES	5
FIGURE 7.	FACE & HEAD LANDMARKS (ANTERIOR VIEW)	8
FIGURE 8.	FACE & HEAD LANDMARKS (LATERAL VIEW)	8
FIGURE 9.	FACE & HEAD LENGTH MEASUREMENTS (LATERAL VIEW)	9
FIGURE 10.	FACE BREADTH MEASUREMENTS (ANTERIOR VIEW)	9
FIGURE 11.	FACE & HEAD BREADTH MEASUREMENTS & REFERENCE PLANE LINES FOR HEIGHT MEASUREMENTS (ANTERIOR VIEW)	10
FIGURE 12.	NASAL BRIDGE HEIGHT MEASUREMENTS FROM REFERENCE PLANE LINES (LATERAL VIEW)	11
FIGURE 13.	PRONASALE HEIGHT MEASUREMENTS FROM REFERENCE PLANE LINES (LATERAL VIEW)	11

LIST OF TABLES

REFERENCE TABLES

TABLE 1.	REFERENCE NUMBERS OF ANTHROPOMETRIC MEASUREMENTS	12
----------	--	----

STATISTICAL SUMMARY TABLES

TABLE 2.	HEAD CIRCUMFERENCE	B-1
TABLE 3.	HEAD BREADTH	B-2
TABLE 4.	HEAD LENGTH	B-3
TABLE 5.	BIORBITAL BREADTH	B-4
TABLE 6.	BICTOCANTHUS BREADTH	B-5
TABLE 7.	BIPUPIL BREADTH	B-6

STATISTICAL SUMMARY TABLES (Continued)

TABLE 8.	BIENTOCANTHUS BREADTH	B-7
TABLE 9.	NASAL BRIDGE BREADTH	B-8
TABLE 10.	BIALAR BREADTH BREADTH	B-9
TABLE 11.	BICHEILION BREADTH	B-10
TABLE 12.	BITRAGON BREADTH	B-11
TABLE 13.	BIZYGOMATIC BREADTH	B-12
TABLE 14.	BIGONIAL BREADTH	B-13
TABLE 15.	SELLION-MENTON LENGTH	B-14
TABLE 16.	SELLION-SUPRAMENTALE LENGTH	B-15
TABLE 17.	SELLION-STOMION LENGTH	B-16
TABLE 18.	SELLION-SUBNASION LENGTH	B-17
TABLE 19.	MIDNASAL BRIDGE HEIGHT FROM MAXILLONASALE PLANE LINE	B-18
TABLE 20.	PRONASALE HEIGHT FROM MAXILLOALARE PLANE LINE	B-19
TABLE 21.	PRONASALE HEIGHT FROM SELLION-PROMENTALE PLANE LINE	B-20
TABLE 22.	SELLION HEIGHT FROM MEDIAL CANTHUS PLANE LINE	B-21
TABLE 23.	SELLION HEIGHT FROM LATERAL ORBITAL PLANE LINE	B-22

HEAD AND FACE ANTHROPOMETRY OF ADULT U.S. CIVILIANS

INTRODUCTION

This report presents a total of 17 traditional and 5 new head and facial dimensions from a random, composite U.S. female and male civilian population measured over a period of 25 years. The 5 new measurements, identified to describe specific anatomical relationships of the face, can have a direct influence on equipment design concepts. The total survey population includes 367 adult subjects (195 females and 172 males) in the age range of 17 through 69 years representing a predominantly high ratio of Caucasian subjects to subjects of other ethnic origins. The survey population includes subjects used in CAMI experimental projects and selected volunteer subjects; it is hereafter referred to as the CAMI/1992 data base. The data summary format is specifically intended for basic design concept use.

These 22 dimensions describe essential anatomical characteristics for use as basic design criteria in the development of protective equipment for the head and face. Currently, there are standardized, traditional anthropometric data that describe adult two-dimensional face and head characteristics of large military populations. While these data typically describe basic dimensions of major surface features or areas, they do not include specific features and/or combinations of features that are considered essential for design use. The reader should also understand that the population demographics of military data may not necessarily represent comparative civilian populations in age range or distribution of dimensional extremes. The limited availability and use of initial 3-dimensional contour plot data (1) provides excellent design criteria, but is not presently available in a practical or convenient format.

In the practice of descriptive anatomy and anthropometry, multiple labels appear in published format descriptions of identical or associated landmarks and dimensions. Because of the lack of standardization of anatomical and anthropometrical terminology, a user of these types of data and labels can be confused or misled.

A thesaurus of selected anatomical and anthropometrical terms, specific to descriptive labels used in this report, is provided as a cross reference for anthropometrical dimensions. This thesaurus is presented in Appendix A.

ANTHROPOMETRIC DATA BASES

A review of major anthropometric surveys (ref. 2 through 15) confirms the absence of certain head and face dimensional data for adult U.S. female civilians and limited data for adult U.S. male civilians. Although the most complete military surveys include both female and male data, there are no known civilian population data bases considered adequate for comparative analysis.

The potential overall effect of data bias, if any, in variable population demographics, is not exactly known when using military data to represent civilian values. Typically, physical changes in facial soft tissue can be associated with age and health status. Relative to this type of soft tissue change caused by factors of age and physical conditioning, these changes in anatomical characteristics of the face may be least affected for design needs.

Most current military surveys are also limited in the number and selection of descriptive dimensions of the face. This is a typical problem that is encountered when attempting to make comparisons between most anthropometric data bases. The experimental design for a major population survey usually provides for only those anthropometric dimensions that are specific to the needs of the target population. Other than the traditional measurements of head length and breadth, face breadth, and nose length, there are few consistent dimension selections from one survey to another.

Specific to the need of understanding the relationship of the CAMI/1992 data established in this report with other available data bases, selected key measurements are used for comparisons of 6 face and 2 head dimensions. These key measurements, selected as typical representations of the primary anatomical features, include head

breadth, head length, face breadth, face length, nose breadth, and nose length. These comparisons provide some basic insight to a generalized relationship between the CAMI/1992 data and the selected referenced data (ref. 2 through 14) in gross proportions and size. All reference data, including both international and U.S. population surveys, are considered to be representative of the basic population demographics in size and shape ranges of proportional anatomical variability. These data define the comparative extreme value ranges. Although there are few international female data for specific key comparisons, the international male data values appear to be valid substitutes. It is typical to find small incremental differences in the extreme low value ranges for female and male international data, particularly in the Asiatic-Pacific populations. For the primary intent of this report, the low percentile data of international males will be appropriate for female comparisons. The earliest composite 1946 survey (2, 3) of 8,543 female and 85,000 male army separatees is one of the primary U.S. data resources used to establish the extreme range of dimensional limits for comparison. The 1946 survey may, in fact, closely represent a general civilian population distribution for females and males.

The remaining key reference sources include anthropometric surveys of Iranian (11), Japanese (13), Korean (8), and Vietnamese (5) male military personnel. With the exception of the Iranian survey, the other Asiatic-Pacific surveys of Japanese, Korean, and Vietnamese represent the smallest facial dimensions that are critical to design needs. Comparisons of Asiatic-Pacific populations are considered vital to establish practical extreme range data. Significant changes are occurring in U.S. anthropometry demographics through the increase of Asiatic-Pacific populations. In many instances, current

equipment designs are compromised in functional performance through lack of proper body fit.

Specific key dimensional relationships between the CAMI/1992 and reference data are illustrated by graphs in figures 1, 2, 3, 4, 5 and 6. These X-Y type graphs plot the data value range as a function of percentile distribution. Selection of reference data for each key dimension (extreme value range) was made on the basis of the lowest and highest value range for females and/or males.

Relative to all key anthropometric dimensions, the CAMI/1992 female data fall within the range limits of data extremes. This type of female distribution is expected, especially with Asiatic-Pacific population data representing some of the smaller face dimension ranges. With the exception of head breadth, the CAMI/1992 data represent the maximum values for data range extremes.

Exceptions to this occur with 95th through 99th percentile values for certain U.S. Army Separatee male data of 1946. The comparative data bases selected for this report represent surveys conducted from 1946 through 1988.

The user of these data should also be aware of the inherent measurement error through observer and instrumentation techniques in soft tissue anthropometry. Valid comparisons of anthropometric surveys should always be made with full awareness of measurement technique and landmark definitions for compatibility. Soft tissue anthropometry is not a precision technique, but should produce acceptable data if surface landmarks are correctly defined and identified.

FIGURE 1. COMPARATIVE HEAD BREADTH PERCENTILES.

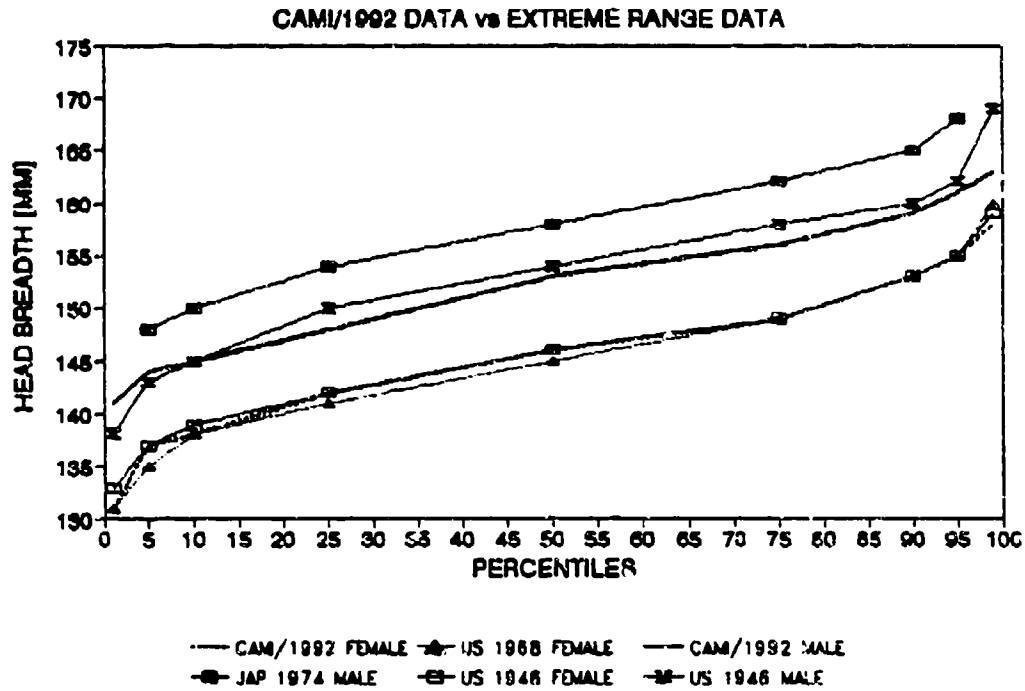


FIGURE 2. COMPARATIVE HEAD LENGTH PERCENTILES.

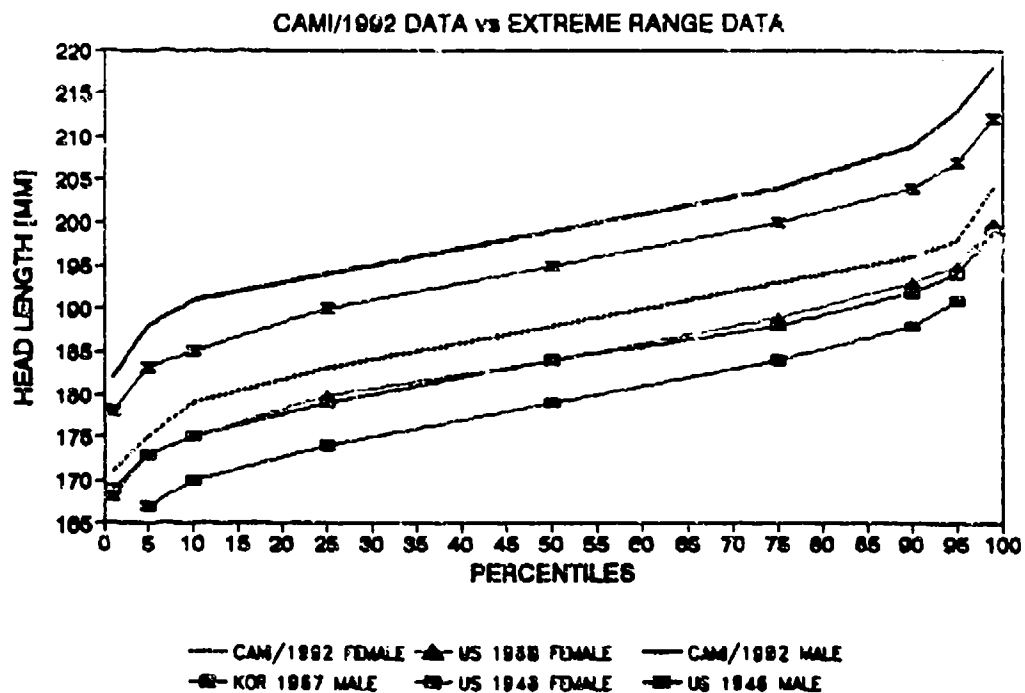


FIGURE 3. COMPARATIVE FACE BREADTH PERCENTILES.

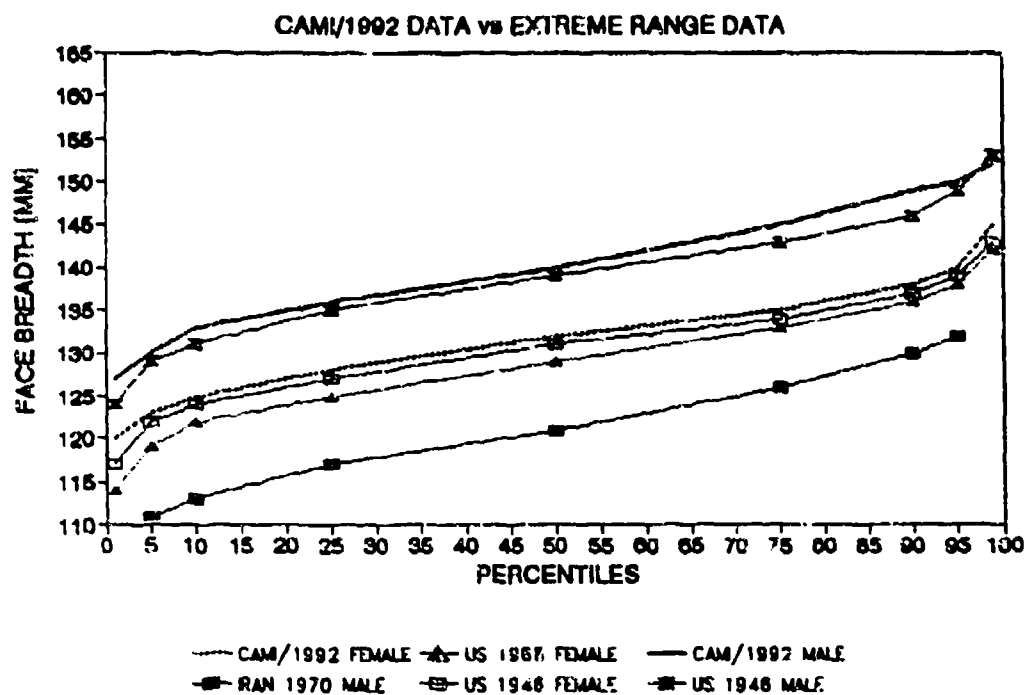


FIGURE 4. COMPARATIVE FACE LENGTH PERCENTILES.

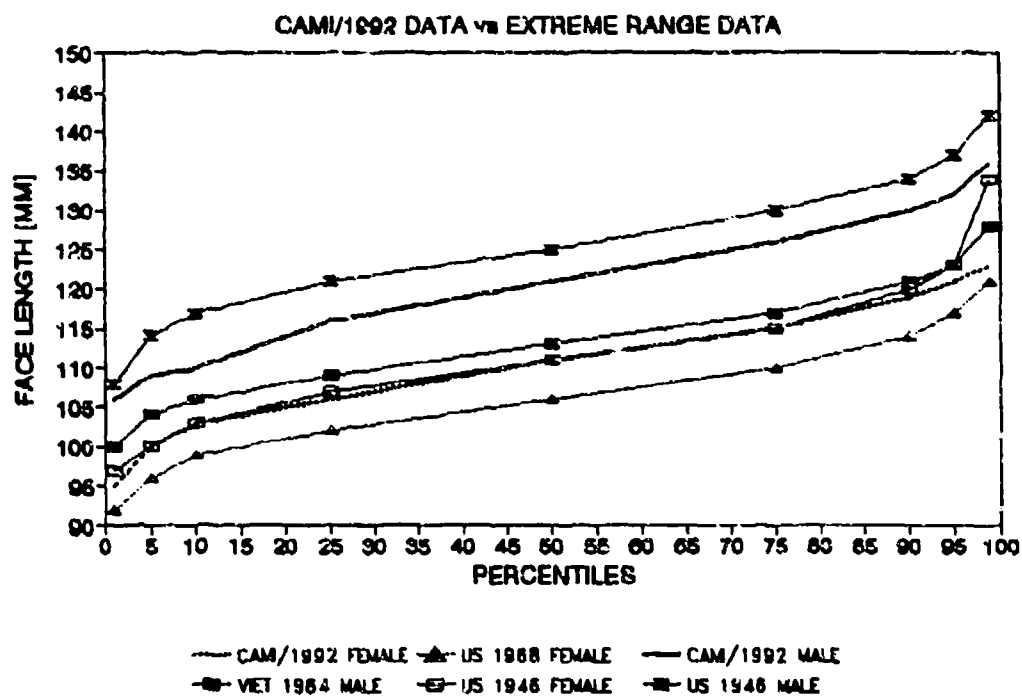


FIGURE 5. COMPARATIVE NOSE BREADTH PERCENTILES.

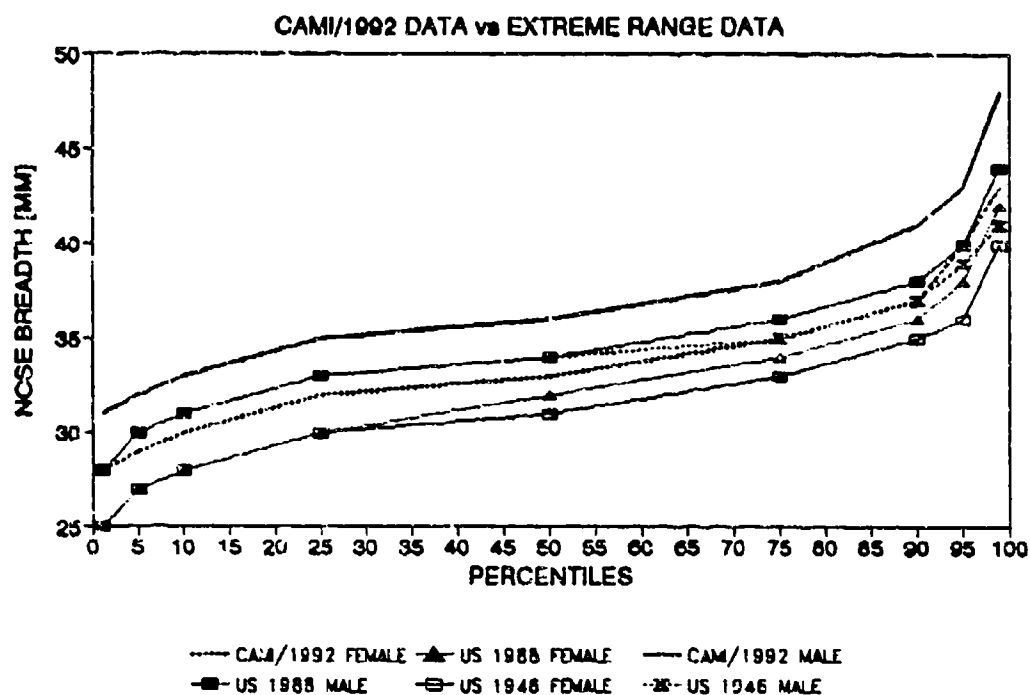
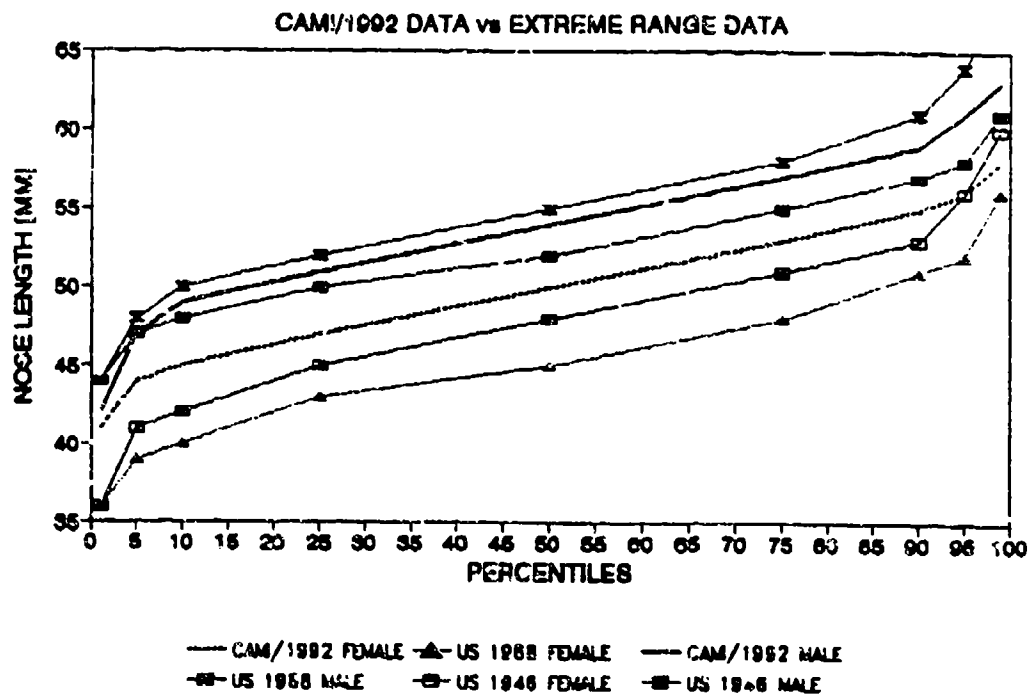


FIGURE 6. COMPARATIVE NOSE LENGTH PERCENTILES.



STATISTICAL DESCRIPTION

Consistent with the intended purpose of this report, statistical summaries of the described data base include 17 traditional anthropometric dimensions of the head and face that are comparable with measurements of other surveys. The maximum number of data subjects used for any measurement is 125 females and 172 males. The five new measurements are (a) Biorbital Breadth, (b) Sellion-Supramentale Length, (c) Midnasal Bridge Height from a Maxillonasale Plane Line, (d) Pronasale Height from a Sellion-Promentale Plane line, (e) Sellion height from a Lateral Orbital Plane Line.

Each of these measurements is identified and described with the individual data tables by gender. Summary statistics are included with each data table for reference purposes. For consistency with traditional anthropometric data formats intended for use as design reference information, all values are presented in both English and metric value systems.

Descriptive statistics included with each measurement table are the minimum and maximum values, mean, standard error of the mean, standard deviation, coefficient of variation, symmetry, and kurtosis. The standard deviation and variance are calculated as sample or unbiased data to provide a correction factor for sample size.

Because of a wide range in total subjects used for various measurements, a comparative statistical analysis of the data used both the sample (unbiased) and population (biased) methods to calculate standard deviation and variance. Although there appear to be no significant differences between sample and population method calculations, the more conservative sample method may be more realistic for smaller sample sizes.

DEFINITIONS OF ANATOMICAL LANDMARKS AND PLANES

Definitions of anatomical landmarks and directional reference planes, used to identify surface measurement points, are listed. In most instances, the surface landmark point represents an internal bone feature that is defined as the actual landmark. It is typical of both anatomical and anthropometrical terminology to have duplicate labels for structures and measurements. Refer to the thesaurus listing of anatomical and anthropometrical terminology to confirm certain interchangeable labels.

Paired surface area points define a line in a derived plane from which a perpendicular distance is measured. Surface landmarks and reference planes used for all measurements are indicated in the anatomical illustrations listed in Figures 7 through 13.

ALARE: The most lateral point or area on the lateral surface of the right and left nostrils.

CHEILION: The lateral junction point of the upper and lower lips. The point is correctly positioned with the lips closed and no facial expression. Right and left points.

ECTOCANTHION: The lateral junction point of the upper and lower eyelids of both right and left eyes.

ECTOORBITALE: The most posterior-lateral point on the frontal process of the zygomatic bone. This point approximates the level of defined ECTOCANTHION landmarks.

ENTOCANTHION: The medial junction point of the upper and lower eyelids of both right and left eyes.

GLABELLA: The most anterior midsagittal point on the forehead at the level of the eyebrow ridges.

GONION: the most posterior-inferior midpoint of the GONIAL Angle formed by the mandibular body and ramus. Right and left points.

LATERAL ORBITAL RIM POINT: A derived point on the anterior-lateral rim of the orbit at a level of the ECTOCANTHUS landmark. The right and left points define the LATERAL ORBITAL PLANE LINE.

LATERAL ORBITAL PLANE LINE: A derived base plane line established for measuring a projection height of SELLION point from the anterior-lateral rim surfaces of the right and left orbits.

MAXILLOALARE: Bilateral points formed by the junction of each maxillary and mid-posterior alar surface areas. These landmarks define the MAXILLOALARE PLANE LINE.

MAXILLOALARE PLANE LINE: A derived base plane line established for measuring a projection height of PRONASALE point away from anterior cheek surfaces.

MAXILLONASALE: Bilateral midpoints along the nose-face junction where the anterior maxillary projection starts to form the nose bridge base. These landmarks define the MAXILLONASALE PLANE LINE.

MAXILLONASALE PLANE LINE: A derived base line plane established for measuring a projection height of MIDNASALE point away from anterior cheek surfaces.

MEDIAL CANTHUS PLANE LINE: A derived base plane line established for measuring a projection height of SELLION point. This line plane is coincident with the right and left ENTOCANTHUS landmarks.

MENTON: The most inferior midsagittal point on the chin.

MIDNASALE: A derived midsagittal point on the nasal bridge midway between the SELLION and PRONASALE points.

MIDPUPIL: The center point of both the right and left eye pupils.

MIDSAGITTAL PLANE: A base anatomical plane that divides the head, face, or other bilateral structures into right and left "mirror-image" parts.

PROMENTALE: The most anterior midsagittal point on the chin prominence.

PRONASALE: The most anterior midsagittal point on the nose tip.

SELLION: The point of greatest midsagittal indentation on the nasal bridge immediately inferior to the supraorbital ridge level.

SELLION-PROMENTALE PLANE LINE: A derived base plane line established for measuring a projection height of SELLION point. This plane line is coincident with the right and left ENTOCANTHUS landmarks.

STOMION: A midsagittal point formed at the junction of closed upper and lower lips when relaxed.

SUBNASALE: A midsagittal point at the junction of the external nasal septum and the superior aspect of the upper lip area (Philtrum).

SUPRAMENTALE: The deepest midsagittal point in the horizontal groove between the lower lip and the chin prominence.

TRAGION: A point located at the most anterior aspect of the upper ear notch formed along the superior edge of the Tragus flap. Right and left points.

ZYGION: The most lateral point on the zygomatic arch for both the right and left sides.

FIGURE 7. FACE & HEAD LANDMARKS.

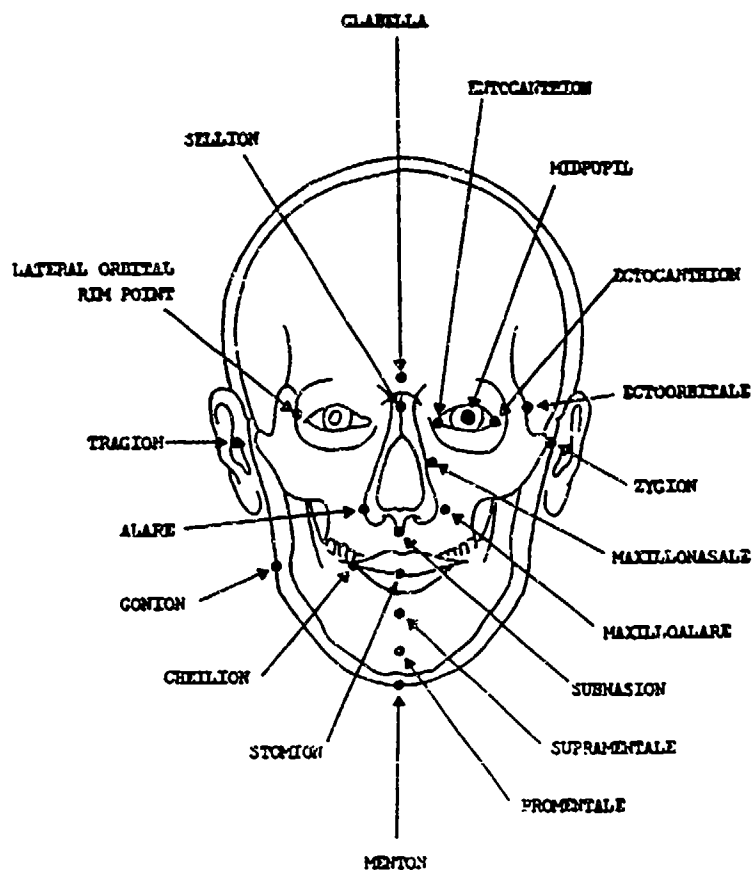


FIGURE 8. FACE & HEAD LANDMARKS.

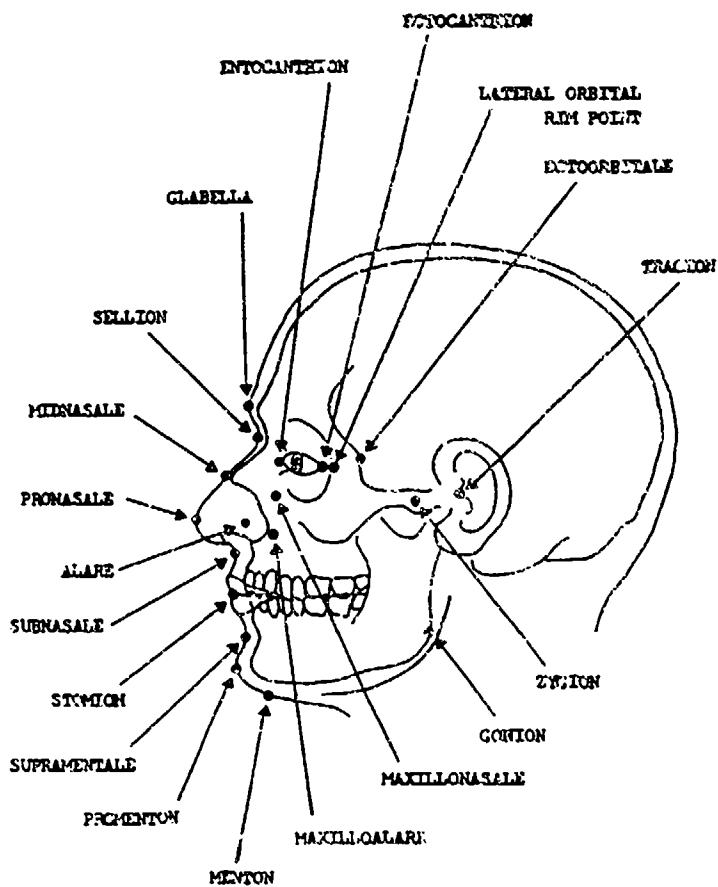


FIGURE 9. FACE & HEAD MEASUREMENTS.

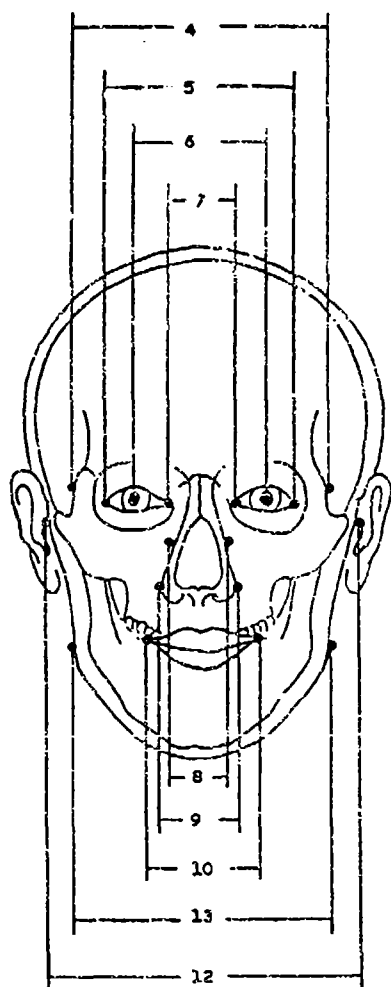


FIGURE 10. FACE BREADTH MEASUREMENTS.

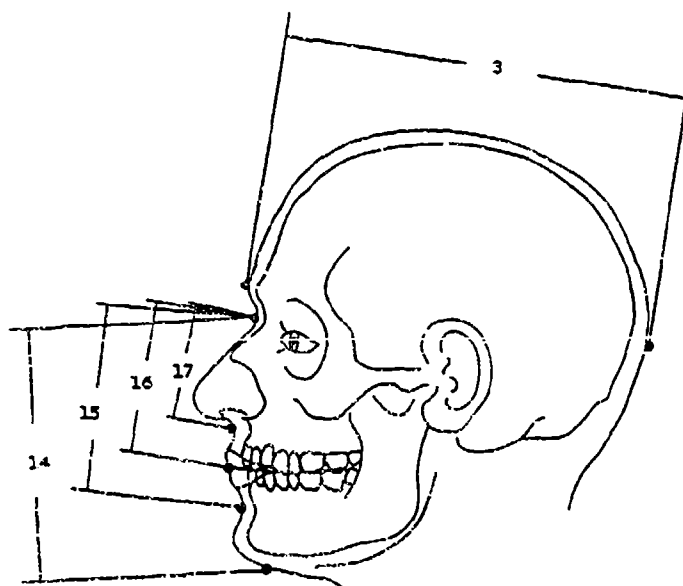


FIGURE 11. FACE & HEAD BREADTH MEASUREMENTS. REFERENCE PLANE LINES FOR HEIGHT MEASUREMENTS.

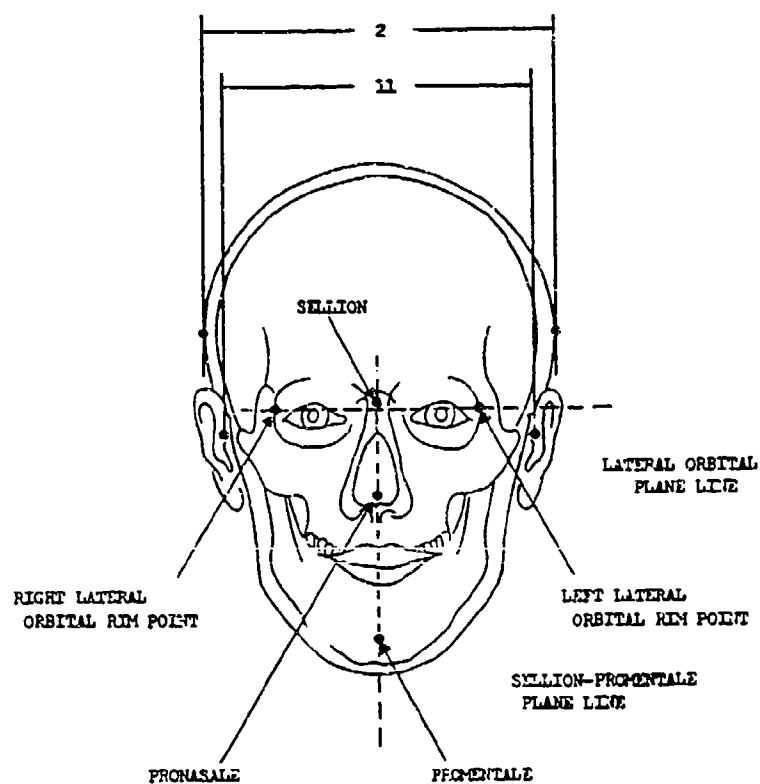


FIGURE 12. NASAL BRIDGE HEIGHT MEASUREMENTS FROM REFERENCE PLANE LINES.

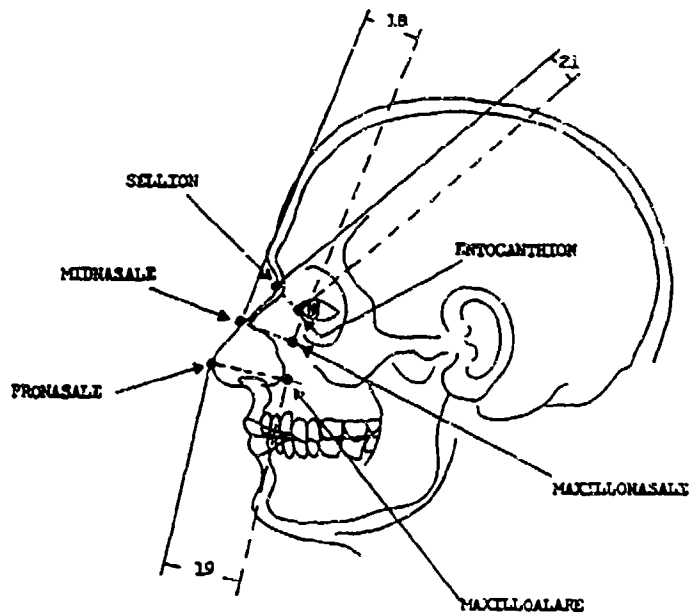
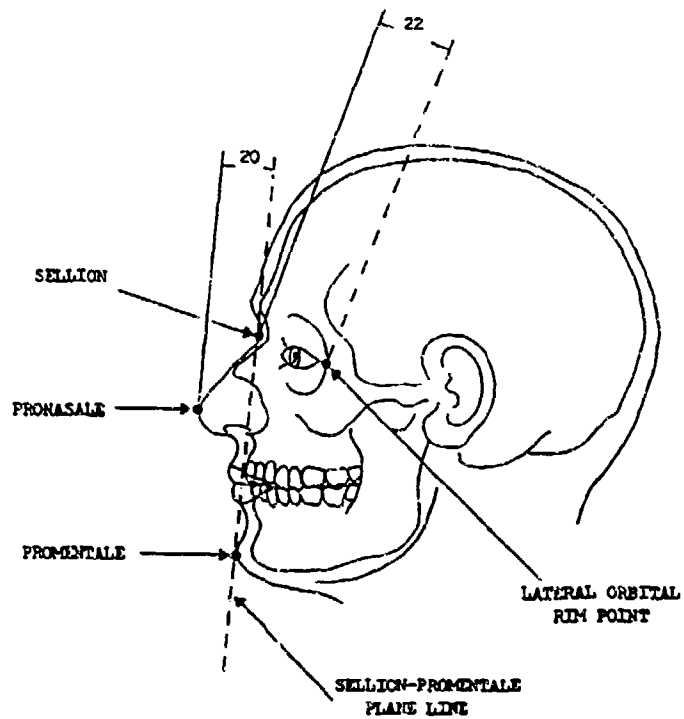


FIGURE 13. PRONASALE HEIGHT MEASUREMENTS FROM REFERENCE PLANE LINES.



DEFINITIONS OF ANTHROPOMETRICAL MEASUREMENTS

By nature, anthropometric instrumentation techniques for measuring deformable soft tissue surfaces do not result in precision measurements. For greatest consistency in reproducing measurement accuracy, soft tissue measure-

ments should be made with only a slight surface contact. Reference numbers are assigned to each anthropometric measurement as indicated in measurement descriptions, illustrations, data summaries, and listed in Table 1.

TABLE 1. REFERENCE NUMBERS OF ANTHROPOMETRIC MEASUREMENTS

MEASUREMENT NUMBER	ANATOMICAL SURFACE REGION AND ANTHROPOMETRIC MEASUREMENT	FIGURE NUMBER
	CRANIUM [ALL]	
1	HEAD CIRCUMFERENCE	NA
2	HEAD BREADTH	11
3	HEAD LENGTH	9
	FACE [BREADTHS]	
4	BIORBITAL BREADTH	10
5	BICTOCANTHUS BREADTH	10
6	BIPUPIL BREADTH	10
7	BIENTOCANTHUS BREADTH	10
8	NASAL BRIDGE BREADTH	10
9	BIALAR BREADTH	10
10	BICHEILION BREADTH	10
11	BITRAGION BREADTH	11
12	BIZYGOMATIC BREADTH	10
13	BIGONIAL BREADTH	10
	FACE [LENGTHS]	
14	SELLION-MENTON LENGTH	9
15	SELLION-SUPRAMENTALE LENGTH	9
16	SELLION-STOMION LENGTH	9
17	SELLION-SUBNASION LENGTH	9
	NOSE [PROJECTION HEIGHTS]	
18	MIDNASAL BRIDGE HEIGHT FROM MAXILLONASALE PLANE LINE	12
19	PRONASALE HEIGHT FROM MAXILLOALARE PLANE LINE	12
20	PRONASALE HEIGHT FROM SELLION-PRONENTALE PLANE LINE	13
21	SELLION HEIGHT FROM MEDIAL CANTHUS PLANE LINE	12
22	SELLION HEIGHT FROM LATERAL ORBITAL PLANE LINE	13

HEAD BREADTH: The maximum bilateral distance between right and left sides of the head. (No.2/Fig.11)

HEAD CIRCUMFERENCE: The maximum distance around the head with the tape placed above the eyebrow ridges and positioned over the greatest posterior projection at the back of the head.

HEAD LENGTH: The maximum distance between GLABELLA and the back of the head in the MIDSAGITTAL PLANE. (No.3/Fig.9)

BIALAR BREADTH: The bilateral distance between right and left ALARE landmarks of the nose. (No.9/ Fig.10)

BICTOCANTHUS BREADTH: The bilateral distance between right and left lateral eyelid junctions (ECTOCANTHION landmarks). (No.5/Fig.10)

BIENTOCANTHUS BREADTH: The bilateral distance between right and left medial eyelid junctions (ENTOCANTHION landmarks). (No.7/Fig.10)

BICHEILION BREADTH: The bilateral distance between right and left CHEILION landmarks without facial expression. (No.10/Fig.10)

BIGONIAL BREADTH: The bilateral distance between right and left GONION landmarks at the GONIAL ANGLES of the mandible. (No.13/Fig.10)

BIORBITAL BREADTH: The bilateral distance between right and left lateral orbital surfaces (ECTO-ORBITALE landmarks). (No.4/Fig.10)

BIPUPIL BREADTH: The bilateral distance between right and left pupil centers of the eyes when looking straight ahead. (No.6/Fig.10)

BITRAGION BREADTH: The bilateral distance between right and left TRAGION landmarks of the ears. Measurement obtained with minimum (slight or minimum compression) tissue contact. (No.11/Fig.11)

BIZYGOMATIC BREADTH: The greatest bilateral distance between the most lateral surfaces of the zygomatic arch (ZYGION landmarks). (No.12/Fig.10)

NASAL BRIDGE BREADTH: The bilateral distance between right and left MAXILLONASALE landmarks at the nose bridge base. (No.8/Fig.10)

SELLION-SUBNASALE LENGTH: The midsagittal distance between SELLION and SUBNASALE landmarks of the nose. (No.17/Fig.9)

SELLION-STOMION LENGTH: The midsagittal distance between SELLION and STOMION landmarks with lips closed and teeth in occlusion. (No.16/Fig.9)

SELLION-SUPRAMENTALE LENGTH: The midsagittal distance between SELLION and SUPRAMENTALE landmarks with the teeth in occlusion. (No.15/Fig.9)

SELLION-MENTON LENGTH: The midsagittal distance between SELLION and MENTON landmarks with the teeth in occlusion. (No.14/Fig.9)

SELLION HEIGHT FROM MEDIAL CANTHUS PLANE LINE: A perpendicular projection distance of the SELLION landmark away from a line coincident with the bilateral areas just medial to ENTOCANTHION landmarks. (No.21/Fig.12)

SELLION HEIGHT FROM LATERAL ORBITAL PLANE LINE: A perpendicular projection distance of the SELLION landmark away from a line coincident with both LATERAL ORBITAL RIM POINTS. (No.22/ Fig.13)

MIDNASALE HEIGHT FROM MAXILLONASALE PLANE LINE: A perpendicular projection distance of the MIDNASALE landmark away from a line coincident with the right and left MAXILLONASALE landmarks. (No.18/Fig.12)

PRONASALE HEIGHT FROM MAXILLOALARE PLANE LINE: A perpendicular projection distance of the PRONASALE landmark away from a line coincident with right and left MAXILLOALARE LANDMARKS. (No.19/Fig.12)

PRONASALE HEIGHT FROM SELLIONPRO-MENTALE PLANE LINE: The perpendicular projection distance of PRONASALE away from a midsagittal line coincident with the SELLION and PROMENTALE landmarks. (No.20/Fig.13)

REFERENCES

1. Young, J.W., Chandler, R.F., Snow, C.C., et al. Anthropometric and Mass Distribution Characteristics of the Adult Female. Washington, D.C.: 1983; FAA publication no. FAA-AM-83-16, Revised Edition.
2. Randall, F.E., Munro, E.H. Reference Anthropometry of Army Women. Report No. 149, Environmental Protection Section, Climatic Research Laboratory, Lawrence, Massachusetts, 1948.
3. Newman, R.W., White, R.M. Reference Anthropometry of Army Men. Report No. 180, Environmental Protection Section, Climatic Research Laboratory, Lawrence, Massachusetts, 1951.
4. Hertzberg, H.T.E., Daniels, G.S., Churchill, E. Anthropometry of Flying Personnel-1950. Technical Report No. 52-321, Wright Air Development Center, Wright Patterson Air Force Base, Ohio, 1954.
5. White, R.M. Anthropometric Survey of the Armed Forces of the Republic of Vietnam. U.S. Army Natick Laboratories, Natick, Massachusetts, 1964.
6. Snow, C.C., Snyder, R.G. Anthropometry of Air Traffic Control Trainees. Washington, D.C.: 1965; FAA publication no. AM 65-26.
7. Unpublished U.S.A.F. Systems Command Anthropometric Data furnished to Webb Associates, Inc., Yellow Springs, Ohio, by the Aerospace Medical Research Laboratories, Wright Patterson Air Force Base, Ohio, 1965.
8. Hart, G.L., Rowland, G.E., Malina, R. Anthropometric Survey of the Armed Forces of the Republic of Korea. Technical Report TR EPT-7, Pioneering Research Laboratory, U.S. Army, Natick Laboratories, Natick, Massachusetts, 1967.
9. White, R.M., Churchill, E. The Body Size of Soldiers: U.S. Army Anthropometry-1966. Technical Report No. 72-51-CE, U.S. Army Natick Laboratories, Natick, Massachusetts, 1971.
10. Unpublished U.S.A.F. Systems Command Anthropometric Data of flying personnel furnished to Webb Associates, Inc., Yellow Springs, Ohio, by the Aerospace Medical Research Laboratories, Wright Patterson Air Force Base, Ohio, 1967.
11. Noorani, S.E., Dillars, C.N. Jr. Anthropometric Survey of the Imperial Iranian Armed Forces, Data Collection and Analysis, Volumes I and II. Technical Report of the Combat Research and Evaluation Center, Imperial Iranian Ground Forces, Teheran, Iran, 1970.
12. Clauser, C.E. et al. Anthropometry of Air Force Women. Technical Report No. 70-5, Aerospace Medical Laboratories, Wright Patterson Air Force Base, Ohio, 1972.
13. Yokohori, E. Anthropometry of JASDF Personnel and Its Application for Human Engineering. Aeromedical Laboratory, Japanese Air Self Defense Force, Tachikawa Air Base, Tokyo, Japan, 1972.
14. Donelson, S.M., Gordon, C.C. 1988 Anthropometric Survey of U.S. Army Personnel: Pilot Summary Statistics. Technical Report Natick/TR-89/044, U.S. Army Natick RD&E Center, Natick, Massachusetts, 1991.

APPENDIX A

ANTHROPOMETRY THESAURUS

This appendix is a thesaurus of selected anthropometrical measurement terms that use multiple labels to identify specific dimensions of superficial head and face structures. The terms listed as REPORT TERMS are those used in this report. Equivalent terms, typical of those found in many published reports, are listed as ALTERNATE TERMS:

REPORT TERMS	ALTERNATE TERMS
BIALAR BREADTH -----	BIALAR DIAMETER NASAL BREADTH NOSE BREADTH
BICHELION BREADTH -----	BICHELION DIAMETER MOUTH BREADTH LIP LENGTH
BICTOCANTHUS BREADTH -----	BIOCULAR BREADTH BIOCULAR BREADTH MAXIMUM BIOCULAR DIAMETER LATERAL CANTHUS DIAMETER
BIENTOCANTHUS BREADTH -----	INTEROCULAR BREADTH INTEROCULAR DIAMETER MEDIAL CANTHUS DIAMETER
BIGONIAL BREADTH -----	BIGONIAL DIAMETER MAXIMUM LOWER FACE BREADTH
BIORBITAL BREADTH -----	MAXIMUM FRONTAL DIAMETER MAXIMUM ORBITAL DIAMETER MAXIMUM BIORBITAL BREADTH
BIPUPIL BREADTH -----	INTERPUPILLARY BREADTH INTERPUPILLARY DIAMETER
BIZYGOMATIC BREADTH -----	FACE BREADTH UPPER FACE BREADTH
HEAD BREADTH -----	HEAD BREADTH MAXIMAL HEAD BREADTH MAXIMAL HEAD DIAMETER
HEAD LENGTH -----	HEAD LENGTH GLABELLAR-OPISTHOCRANION LENGTH

REPORT TERMS**ALTERNATE TERMS**

MIDNASAL BRIDGE HEIGHT FROM
MAXILLONASALE PLANE LINE -----

NASAL BRIDGE HEIGHT
NASAL BRIDGE SALIENT

NASAL BRIDGE BREADTH -----

NOSE BRIDGE BREADTH

PRONASALE HEIGHT FROM MAXILLONASALE
PLANE LINE -----

NOSE PROJECTION
HORIZONTAL NOSE PROTRUSION
NASAL TIP SALIENT

SELLION HEIGHT FROM MEDIAL CANTHUS
PLANE LINE -----

NASAL ROOT SALIENT
NASAL ROOT HEIGHT

SELLION-MENTON LENGTH -----

MENTON-SELLION LENGTH
FACE LENGTH
TOTAL FACE LENGTH
FACE HEIGHT

SELLION-SUBNASION LENGTH-----

SUBNASALE-SELLION LENGTH
SUBNASALE-NASAL ROOT DEPRESSION LENGTH
NASAL HEIGHT
NOSE HEIGHT
NOSE LENGTH

APPENDIX B

TABLE 2. HEAD CIRCUMFERENCE

FEMALE			MALE		
SUMMARY STATISTICS			SUMMARY STATISTICS		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
549.84	MEAN	21.65	574.54	MEAN	22.62
1.88	STD ERROR(MEAN)	0.07	1.55	STD ERROR(MEAN)	0.06
20.48	STD DEVIATION	3.71	16.22	STD DEVIATION	0.64
506.98	MINIMUM	19.96	541.02	MINIMUM	21.30
614.93	MAXIMUM	24.21	620.01	MAXIMUM	24.41
COEFF. OF VARIATION(%)		3.71	COEFF. OF VARIATION(%)		2.81
SYMMETRY		0.54	SYMMETRY		0.24
KURTOSIS		3.37	KURTOSIS		2.39
NUMBER OF SUBJECTS		119	NUMBER OF SUBJECTS		110
PERCENTILES			PERCENTILES		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
506.98	1 ST	19.96	547.88	1 ST	21.57
518.92	5 TH	20.43	549.91	5 TH	21.65
525.02	10 TH	20.67	554.99	10 TH	21.85
534.92	25 TH	21.06	560.07	25 TH	22.05
547.88	50 TH	21.57	573.02	50 TH	22.56
561.09	75 TH	22.09	586.99	75 TH	23.11
574.04	90 TH	22.60	595.12	90 TH	23.43
581.91	95 TH	22.91	599.95	95 TH	23.62
605.03	99 TH	23.82	608.08	99 TH	23.94

HEAD CIRCUMFERENCE: The maximum distance around the head with the tape placed above the eyebrow ridges and positioned over the greatest posterior projection at the back of the head.

TABLE 3. HEAD BREADTH

FEMALE			MALE		
SUMMARY STATISTICS			SUMMARY STATISTICS		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
145.76	MEAN	5.74	152.39	MEAN	6.00
0.43	STD ERROR(MEAN)	0.02	0.41	STD ERROR(MEAN)	0.02
5.57	STD DEVIATION	0.22	5.34	STD DEVIATION	0.21
128.02	MINIMUM	5.04	138.94	MINIMUM	5.47
161.04	MAXIMUM	6.34	166.12	MAXIMUM	6.54
COEFF. OF VARIATION(%)		3.80	COEFF. OF VARIATION(%)		3.50
SYMMETRY		0.02	SYMMETRY		-0.01
KURTOSIS		3.25	KURTOSIS		2.48
NUMBER OF SUBJECTS		169	NUMBER OF SUBJECTS		167
PERCENTILES			PERCENTILES		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
131.06	1 ST	5.16	140.97	1 ST	5.55
136.91	5 TH	5.39	144.02	5 TH	5.67
137.92	10 TH	5.43	145.03	10 TH	5.71
141.99	25 TH	5.59	148.08	25 TH	5.83
146.05	50 TH	5.75	152.91	50 TH	6.02
149.10	75 TH	5.87	155.96	75 TH	6.14
152.91	90 TH	6.02	159.00	90 TH	6.26
154.94	95 TH	6.10	161.04	95 TH	6.34
157.99	99 TH	6.22	163.07	99 TH	6.42

HEAD BREADTH: The maximum bilateral distance between the right and left sides of the head.

TABLE 4. HEAD LENGTH

FEMALE			MALE		
SUMMARY STATISTICS			SUMMARY STATISTICS		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
187.84	MEAN	7.40	199.57	MEAN	7.86
0.56	STD ERROR(MEAN)	0.02	0.59	STD ERROR(MEAN)	0.02
7.29	STD DEVIATION	0.29	7.56	STD DEVIATION	0.30
165.10	MINIMUM	6.50	180.09	MINIMUM	7.09
216.92	MAXIMUM	8.54	223.01	MAXIMUM	8.78
COEFF. OF VARIATION(%)		3.86	COEFF. OF VARIATION(%)		3.76
SYMMETRY		0.21	SYMMETRY		0.32
KURTOSIS		4.32	KURTOSIS		3.62
NUMBER OF SUBJECTS		169	NUMBER OF SUBJECTS		166
PERCENTILES			PERCENTILES		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
170.94	1 ST	6.73	182.12	1 ST	7.17
175.01	5 TH	6.89	187.96	5 TH	7.40
179.07	10 TH	7.05	191.01	10 TH	7.52
182.88	25 TH	7.20	194.06	25 TH	7.64
187.96	50 TH	7.40	198.88	50 TH	7.83
193.04	75 TH	7.60	203.96	75 TH	8.03
196.09	90 TH	7.72	209.04	90 TH	8.23
198.12	95 TH	7.80	213.11	95 TH	8.39
203.96	99 TH	8.03	217.93	99 TH	8.58

HEAD LENGTH: The maximum distance between GLABELLA and the back of the head in the MIDSAGITTAL PLANE.

TABLE 5. BIORBITAL BREADTH

FEMALE			MALE		
SUMMARY STATISTICS			SUMMARY STATISTICS		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
113.79	MEAN	4.48	119.01	MEAN	4.69
0.43	STD ERROR(MEAN)	0.02	0.50	STD ERROR(MEAN)	0.02
5.05	STD DEVIATION	0.20	5.81	STD DEVIATION	0.23
102.11	MINIMUM	4.02	99.06	MINIMUM	3.90
128.02	MAXIMUM	5.04	134.87	MAXIMUM	5.32
COEFF. OF VARIATION(%)		4.42	COEFF. OF VARIATION(%)		4.88
SYMMETRY		0.31	SYMMETRY		-0.39
KURTOSIS		2.76	KURTOSIS		3.98
NUMBER OF SUBJECTS		140	NUMBER OF SUBJECTS		137
PERCENTILES			PERCENTILES		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
102.11	1 ST	4.02	99.06	1 ST	3.90
105.92	5 TH	4.17	107.95	5 TH	4.25
107.95	10 TH	4.25	112.01	10 TH	4.41
109.98	25 TH	4.33	115.06	25 TH	4.53
113.03	50 TH	4.45	119.13	50 TH	4.69
118.11	75 TH	4.65	122.94	75 TH	4.84
119.89	90 TH	4.72	125.98	90 TH	4.96
121.92	95 TH	4.80	128.02	95 TH	5.04
125.98	99 TH	4.96	133.10	99 TH	5.24

BIORBITAL BREADTH: The bilateral distance between the right and left lateral orbital surfaces (ECTOORBITAL landmarks).

TABLE 6. BIECTOCANTHUS BREADTH

FEMALE			MALE		
SUMMARY STATISTICS			SUMMARY STATISTICS		
CENTIMETERS		INCHES	CENTIMETERS		INCHES
88.53	MEAN	3.49	91.31	MEAN	3.60
0.41	STD ERROR (MEAN)	0.02	0.50	STD ERROR (MEAN)	0.02
4.70	STD DEVIATION	0.19	4.99	STD DEVIATION	0.20
76.96	MINIMUM	3.03	82.04	MINIMUM	3.23
103.89	MAXIMUM	4.09	107.95	MAXIMUM	4.25
COEFF. OF VARIATION(%)		5.41	COEFF. OF VARIATION(%)		5.43
SYMMETRY		0.44	SYMMETRY		0.57
KURTOSIS		3.01	KURTOSIS		3.41
NUMBER OF SUBJECTS		134	NUMBER OF SUBJECTS		101
PERCENTILES			PERCENTILES		
CENTIMETERS		INCHES	CENTIMETERS		INCHES
76.96	1 ST	3.03	82.04	1 ST	3.23
82.04	5 TH	3.23	84.07	5 TH	3.31
83.06	10 TH	3.27	84.58	10 TH	3.33
85.09	25 TH	3.35	87.88	25 TH	3.46
87.88	50 TH	3.46	90.93	50 TH	3.56
90.93	75 TH	3.58	93.98	75 TH	3.70
95.00	90 TH	3.74	98.04	90 TH	3.86
97.03	95 TH	3.82	101.09	95 TH	3.98
100.08	99 TH	3.94	103.12	99 TH	4.06

BIECTOCANTHUS BREADTH: The bilateral distance between the right and left lateral eyelid junctions (ECTOCANTHION landmarks).

TABLE 7. BIPUPIL BREADTH

FEMALE			MALE		
SUMMARY STATISTICS			SUMMARY STATISTICS		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
58.44	MEAN	2.30	61.39	MEAN	2.42
0.28	STD ERROR(MEAN)	0.01	0.36	STD ERROR(MEAN)	0.01
3.32	STD DEVIATION	0.13	3.63	STD DEVIATION	0.14
52.07	MINIMUM	2.05	54.99	MINIMUM	2.17
68.07	MAXIMUM	2.68	70.99	MAXIMUM	2.80
COEFF. OF VARIATION(%)		5.66	COEFF. OF VARIATION(%)		5.88
SYMMETRY		0.50	SYMMETRY		0.55
KURTOSIS		2.85	KURTOSIS		2.99
NUMBER OF SUBJECTS		156	NUMBER OF SUBJECTS		102
PERCENTILES			PERCENTILES		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
52.07	1 ST	2.05	54.99	1 ST	2.17
54.10	5 TH	2.13	56.01	5 TH	2.20
54.61	10 TH	2.15	57.00	10 TH	2.24
55.88	25 TH	2.20	59.00	25 TH	2.32
57.91	50 TH	2.28	61.01	50 TH	2.40
59.94	75 TH	2.36	62.99	75 TH	2.48
62.99	90 TH	2.48	65.99	90 TH	2.60
64.01	95 TH	2.52	68.00	95 TH	2.68
68.07	99 TH	2.68	70.99	99 TH	2.90

BIPUPIL BREADTH: The bilateral distance between the right and left pupil centers of the eyes when looking straight ahead.

TABLE 8. BIENTOCANTHUS BREADTH

FEMALE			MALE		
SUMMARY STATISTICS			SUMMARY STATISTICS		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
30.57	MEAN	1.20	32.08	MEAN	1.26
0.23	STD ERROR(MEAN)	0.01	0.27	STD ERROR(MEAN)	0.01
2.71	STD DEVIATION	0.11	2.95	STD DEVIATION	0.12
23.88	MINIMUM	0.95	25.91	MINIMUM	1.02
39.89	MAXIMUM	1.58	39.88	MAXIMUM	1.58
COEFF. OF VARIATION(%)		8.72	COEFF. OF VARIATION(%)		9.03
SYMMETRY		0.25	SYMMETRY		0.52
KURTOSIS		4.04	KURTOSIS		2.76
NUMBER OF SUBJECTS		145	NUMBER OF SUBJECTS		115
PERCENTILES			PERCENTILES		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
23.88	1 ST	0.94	25.91	1 ST	1.02
25.91	5 TH	1.02	27.94	5 TH	1.10
26.92	10 TH	1.06	28.96	10 TH	1.14
28.96	25 TH	1.14	29.97	25 TH	1.18
29.97	50 TH	1.18	32.00	50 TH	1.26
32.00	75 TH	1.26	34.04	75 TH	1.34
34.04	90 TH	1.34	36.07	90 TH	1.42
35.05	95 TH	1.38	37.08	95 TH	1.46
39.12	99 TH	1.54	39.12	99 TH	1.54

BIENTOCANTHUS BREADTH: The bilateral distance between the right and left medial eyelid junctions (ENTOCANTHION landmarks).

TABLE 9. NASAL BRIDGE BREADTH

FEMALE			MALE		
SUMMARY STATISTICS			SUMMARY STATISTICS		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
31.83	MEAN	1.25	33.17	MEAN	1.31
0.21	STD ERROR(MEAN)	0.01	0.25	STD ERROR(MEAN)	0.01
2.72	STD DEVIATION	0.11	2.99	STD DEVIATION	0.12
23.11	MINIMUM	0.91	25.91	MINIMUM	1.02
39.88	MAXIMUM	1.58	39.12	MAXIMUM	1.54
COEFF. OF VARIATION(%)		8.42	COEFF. OF VARIATION(%)		8.86
SYMMETRY		0.03	SYMMETRY		-0.34
KURTOSIS		3.45	KURTOSIS		2.62
NUMBER OF SUBJECTS		174	NUMBER OF SUBJECTS		145
PERCENTILES			PERCENTILES		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
24.89	1 ST	0.98	25.91	1 ST	1.02
26.92	5 TH	1.06	27.94	5 TH	1.10
28.96	10 TH	1.14	28.96	10 TH	1.14
29.97	25 TH	1.18	30.99	25 TH	1.22
32.00	50 TH	1.26	33.02	50 TH	1.30
33.02	75 TH	1.30	35.05	75 TH	1.38
35.05	90 TH	1.38	37.08	90 TH	1.46
36.07	95 TH	1.42	38.10	95 TH	1.50
38.10	99 TH	1.50	39.12	99 TH	1.54

NASAL BRIDGE BREADTH: The bilateral distance between the right and left MAXILLONASALE landmarks at the nose bridge base.

TABLE 10. BIALAR BREADTH

FEMALE			MALE		
SUMMARY STATISTICS			SUMMARY STATISTICS		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
33.29	MEAN	1.31	36.78	MEAN	1.45
0.24	STD ERROR(MEAN)	0.01	0.28	STD ERROR(MEAN)	0.01
3.16	STD DEVIATION	0.13	3.42	STD DEVIATION	0.14
27.00	MINIMUM	1.06	30.99	MINIMUM	1.22
43.00	MAXIMUM	1.69	50.04	MAXIMUM	1.97
COEFF. OF VARIATION(%)		9.56	COEFF. OF VARIATION(%)		9.33
SYMMETRY		1.02	SYMMETRY		0.92
KURTOSIS		4.44	KURTOSIS		4.37
NUMBER OF SUBJECTS		172	NUMBER OF SUBJECTS		145
PERCENTILES			PERCENTILES		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
27.94	1 ST	1.10	30.99	1 ST	1.22
28.96	5 TH	1.14	32.00	5 TH	1.26
29.97	10 TH	1.18	32.51	10 TH	1.28
32.00	25 TH	1.26	35.05	25 TH	1.38
33.02	50 TH	1.30	36.07	50 TH	1.42
35.05	75 TH	1.38	38.10	75 TH	1.50
37.08	90 TH	1.46	40.89	90 TH	1.61
39.88	95 TH	1.57	42.93	95 TH	1.69
42.93	99 TH	1.69	48.01	99 TH	1.89

BIALAR BREADTH: The bilateral distance between the right and left ALARE landmarks of the nose.

TABLE 11. BICHEILION BREADTH

FEMALE			MALE		
SUMMARY STATISTICS			SUMMARY STATISTICS		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
48.25	MEAN	1.90	52.23	MEAN	2.06
0.33	STD ERROR(MEAN)	0.01	0.36	STD ERROR(MEAN)	0.01
3.95	STD DEVIATION	0.21	3.91	STD DEVIATION	0.15
37.08	MINIMUM	1.46	42.93	MINIMUM	1.69
56.90	MAXIMUM	2.24	62.99	MAXIMUM	2.48
COEFF. OF VARIATION(%)		8.06	COEFF. OF VARIATION(%)		7.47
SYMMETRY		0.05	SYMMETRY		-0.01
KURTOSIS		2.65	KURTOSIS		3.13
NUMBER OF SUBJECTS		145	NUMBER OF SUBJECTS		115
PERCENTILES			PERCENTILES		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
37.08	1 ST	1.46	42.93	1 ST	1.69
41.91	5 TH	1.65	43.94	5 TH	1.73
42.93	10 TH	1.69	48.01	10 TH	1.89
44.96	25 TH	1.77	50.04	25 TH	1.97
48.01	50 TH	1.89	52.07	50 TH	2.05
51.05	75 TH	2.01	55.12	75 TH	2.17
53.09	90 TH	2.09	56.90	90 TH	2.24
55.12	95 TH	2.17	57.91	95 TH	2.28
56.90	99 TH	2.24	60.96	99 TH	2.40

BICHEILION BREADTH: The bilateral distance between the right and left CHEILION landmarks without facial expression.

TABLE 12. BITRAGION BREADTH

FEMALE			MALE		
SUMMARY STATISTICS			SUMMARY STATISTICS		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
131.70	MEAN	5.19	140.89	MEAN	5.55
0.50	STD ERROR (MEAN)	0.02	0.58	STD ERROR (MEAN)	0.02
5.47	STD DEVIATION	0.22	5.75	STD DEVIATION	0.23
119.13	MINIMUM	4.69	128.02	MINIMUM	5.04
144.02	MAXIMUM	5.67	152.91	MAXIMUM	6.02
COEFF. OF VARIATION (%)		4.14	COEFF. OF VARIATION (%)		4.05
SYMMETRY		0.14	SYMMETRY		-0.04
KURTOSIS		2.49	KURTOSIS		2.25
NUMBER OF SUBJECTS		120	NUMBER OF SUBJECTS		98
PERCENTILES			PERCENTILES		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
119.13	1 ST	4.69	128.02	1 ST	5.04
121.92	5 TH	4.80	132.08	5 TH	5.20
123.95	10 TH	4.88	133.10	10 TH	5.24
127.00	25 TH	5.00	136.40	25 TH	5.37
132.08	50 TH	5.20	141.99	50 TH	5.59
134.87	75 TH	5.31	145.03	75 TH	5.71
138.94	90 TH	5.47	149.10	90 TH	5.87
140.97	95 TH	5.55	150.11	95 TH	5.91
143.00	99 TH	5.63	151.91	99 TH	5.98

BITRAGION BREADTH: The bilateral distance between the right and left TRAGION landmarks of the ears. Measurement obtained with minimum (no compression) tissue contact.

TABLE 13. BIZYGOMATIC BREADTH

FEMALE			MALE		
SUMMARY STATISTICS			SUMMARY STATISTICS		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
131.81	MEAN	5.18	140.67	MEAN	5.54
0.36	STD ERROR(MEAN)	0.01	0.46	STD ERROR(MEAN)	0.02
5.09	STD DEVIATION	0.20	6.02	STD DEVIATION	0.24
119.12	MINIMUM	4.68	125.98	MINIMUM	4.96
148.08	MAXIMUM	5.83	152.91	MAXIMUM	6.02
COEFF. OF VARIATION(%)		3.85	COEFF. OF VARIATION(%)		4.26
SYMMETRY		0.12	SYMMETRY		-0.08
KURTOSIS		3.11	KURTOSIS		2.53
NUMBER OF SUBJECTS		195	NUMBER OF SUBJECTS		171
PERCENTILES			PERCENTILES		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
119.89	1 ST	4.72	127.00	1 ST	5.00
120.94	5 TH	4.84	130.05	5 TH	5.12
124.97	10 TH	4.92	133.10	10 TH	5.24
128.02	25 TH	5.04	135.89	25 TH	5.35
132.09	50 TH	5.20	139.95	50 TH	5.51
134.57	75 TH	5.31	145.03	75 TH	5.71
137.92	90 TH	5.43	149.10	90 TH	5.87
139.95	95 TH	5.51	150.11	95 TH	5.91
145.03	99 TH	5.71	151.89	99 TH	5.98

BIZYGOMATIC BREADTH: The greatest bilateral distance between the lateral cheek surfaces of the zygomatic arch (ZYGION landmarks).

TABLE 14. BIGONIAL BREADTH

FEMALE			MALE		
SUMMARY STATISTICS			SUMMARY STATISTICS		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
100.87	MEAN	3.97	108.50	MEAN	4.27
0.41	STD ERROR(MEAN)	0.02	0.59	STD ERROR(MEAN)	0.02
5.40	STD DEVIATION	0.21	7.05	STD DEVIATION	0.28
84.07	MINIMUM	3.31	90.93	MINIMUM	3.58
117.09	MAXIMUM	4.61	133.10	MAXIMUM	5.24
COEFF. OF VARIATION(%)		5.34	COEFF. OF VARIATION(%)		6.47
SYMMETRY		0.15	SYMMETRY		0.43
KURTOSIS		3.22	KURTOSIS		3.54
NUMBER OF SUBJECTS		174	NUMBER OF SUBJECTS		144
PERCENTILES			PERCENTILES		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
87.12	1 ST	3.43	90.93	1 ST	3.58
91.95	5 TH	3.62	97.03	5 TH	3.82
92.96	10 TH	3.66	100.08	10 TH	3.94
97.03	25 TH	3.82	103.89	25 TH	4.09
101.09	50 TH	3.98	107.95	50 TH	4.25
103.89	75 TH	4.09	113.03	75 TH	4.45
107.95	90 TH	4.25	117.09	90 TH	4.61
109.98	95 TH	4.33	119.13	95 TH	4.69
112.01	99 TH	4.41	128.02	99 TH	5.04

BIGONIAL BREADTH: The bilateral distance between the right and left GONION landmarks at the GONIAL ANGLES of the mandible.

TABLE 15. SELLION-MENTON LENGTH

FEMALE			MALE		
SUMMARY STATISTICS			SUMMARY STATISTICS		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
110.97	MEAN	4.37	120.91	MEAN	4.76
0.46	STD ERROR(MEAN)	0.02	0.56	STD ERROR(MEAN)	0.56
6.47	STD DEVIATION	0.25	7.36	STD DEVIATION	0.29
93.98	MINIMUM	3.70	105.92	MINIMUM	4.17
133.10	MAXIMUM	5.24	139.95	MAXIMUM	5.51
COEFF. OF VARIATION(%)		5.80	COEFF. OF VARIATION(%)		6.07
SYMMETRY		0.27	SYMMETRY		0.09
KURTOSIS		3.33	KURTOSIS		2.57
NUMBER OF SUBJECTS		195	NUMBER OF SUBJECTS		172
PERCENTILES			PERCENTILES		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
95.00	1 ST	3.74	105.92	1 ST	4.17
100.08	5 TH	3.94	108.97	5 TH	4.29
103.12	10 TH	4.06	109.98	10 TH	4.33
105.92	25 TH	4.17	116.08	25 TH	4.57
111.00	50 TH	4.37	120.90	50 TH	4.76
115.06	75 TH	4.53	125.98	75 TH	4.96
119.13	90 TH	4.69	130.05	90 TH	5.12
120.90	95 TH	4.76	132.08	95 TH	5.20
122.94	99 TH	4.84	136.91	99 TH	5.39

SELLION-MENTON LENGTH: The midsagittal distance between the SELLION and MENTON landmarks with the teeth in occlusion.

TABLE 16. SELLION-SUPRAMENTALE LENGTH

FEMALE			MALE		
SUMMARY STATISTICS			SUMMARY STATISTICS		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
85.68	MEAN	3.37	93.20	MEAN	3.67
0.48	STD ERROR(MEAN)	0.02	0.62	STD ERROR(MEAN)	0.02
5.78	STD DEVIATION	0.23	6.66	STD DEVIATION	0.26
71.88	MINIMUM	2.84	80.01	MINIMUM	3.15
107.95	MAXIMUM	4.25	109.98	MAXIMUM	4.33
COEFF. OF VARIATION(%)		6.73	COEFF. OF VARIATION(%)		7.12
SYMMETRY		0.41	SYMMETRY		0.17
KURTOSIS		3.69	KURTOSIS		2.51
NUMBER OF SUBJECTS		145	NUMBER OF SUBJECTS		115
PERCENTILES			PERCENTILES		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
71.88	1 ST	2.83	80.01	1 ST	3.15
75.95	5 TH	2.99	83.06	5 TH	3.27
78.99	10 TH	3.11	84.07	10 TH	3.31
82.04	25 TH	3.23	88.90	25 TH	3.50
85.09	50 TH	3.35	92.96	50 TH	3.66
88.90	75 TH	3.50	97.03	75 TH	3.82
92.96	90 TH	3.66	101.09	90 TH	3.98
95.00	95 TH	3.74	104.90	95 TH	4.13
99.06	99 TH	3.90	107.95	99 TH	4.25

SELLION-SUPRAMENTALE LENGTH: The midsagittal distance between the SELLION and SUPRAMENTALE landmarks with the teeth in normal occlusion.

TABLE 17. SELLION-STOMION LENGTH

FEMALE			MALE		
SUMMARY STATISTICS			SUMMARY STATISTICS		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
69.01	MEAN	2.72	75.70	MEAN	2.98
0.37	STD ERROR(MEAN)	0.37	0.44	STD ERROR(MEAN)	0.02
4.46	STD DEVIATION	0.18	4.71	STD DEVIATION	0.19
55.88	MINIMUM	2.21	65.02	MINIMUM	2.56
83.06	MAXIMUM	3.27	90.93	MAXIMUM	3.58
COEFF. OF VARIATION(%)		6.45	COEFF. OF VARIATION(%)		6.20
SYMMETRY		0.16	SYMMETRY		0.25
KURTOSIS		3.11	KURTOSIS		3.15
NUMBER OF SUBJECTS		145	NUMBER OF SUBJECTS		115
PERCENTILES			PERCENTILES		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
55.88	1 ST	2.20	65.02	1 ST	2.56
61.98	5 TH	2.44	68.07	5 TH	2.68
62.99	10 TH	2.48	69.09	10 TH	2.72
66.04	25 TH	2.60	71.88	25 TH	2.83
69.09	50 TH	2.72	74.93	50 TH	2.95
71.88	75 TH	2.83	77.98	75 TH	3.07
74.93	90 TH	2.95	81.03	90 TH	3.19
75.95	95 TH	2.99	83.06	95 TH	3.27
80.01	99 TH	3.15	86.11	99 TH	3.39

SELLION-STOMION LENGTH: The midsagittal distance between the SELLION and STOMION landmarks with the lips closed and teeth in occlusion.

TABLE 18. SELLION-SUBNASION LENGTH

FEMALE			MALE		
SUMMARY STATISTICS			SUMMARY STATISTICS		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
50.18	MEAN	1.98	54.01	MEAN	2.13
0.30	STD ERROR(MEAN)	0.01	0.34	STD ERROR(MEAN)	0.34
3.83	STD DEVIATION	0.15	4.09	STD DEVIATION	0.16
38.10	MINIMUM	1.50	41.91	MINIMUM	1.65
62.99	MAXIMUM	2.48	62.89	MAXIMUM	2.48
COEFF. OF VARIATION(%)		7.56	COEFF. OF VARIATION(%)		7.60
SYMMETRY		0.01	SYMMETRY		-0.08
KURTOSIS		3.31	KURTOSIS		2.67
NUMBER OF SUBJECTS		175	NUMBER OF SUBJECTS		145
PERCENTILES			PERCENTILES		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
40.89	1 ST	1.61	41.91	1 ST	1.65
43.94	5 TH	1.73	46.99	5 TH	1.85
44.96	10 TH	1.77	49.02	10 TH	1.93
46.99	25 TH	1.85	51.05	25 TH	2.01
50.04	50 TH	1.97	54.10	50 TH	2.13
53.09	75 TH	2.09	56.90	75 TH	2.24
55.12	90 TH	2.17	58.93	90 TH	2.32
55.88	95 TH	2.20	60.96	95 TH	2.40
57.91	99 TH	2.28	62.99	99 TH	2.48

SELLION-SUBNASION LENGTH: The midsagittal distance between the SELLION and SUBNASION landmarks of the nose.

TABLE 19. MIDNASAL BRIDGE HEIGHT FROM MAXILLONASALE PLANE LINE

FEMALE			MALE		
SUMMARY STATISTICS			SUMMARY STATISTICS		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
21.96	MEAN	0.86	25.44	MEAN	1.00
0.27	STD ERROR(MEAN)	0.01	0.34	STD ERROR(MEAN)	0.01
2.97	STD DEVIATION	0.12	3.55	STD DEVIATION	0.14
13.10	MINIMUM	0.55	18.03	MINIMUM	0.71
29.01	MAXIMUM	1.14	39.12	MAXIMUM	1.54
COEFF. OF VARIATION(%)		13.48	COEFF. OF VARIATION(%)		13.94
SYMMETRY		0.04	SYMMETRY		0.72
KURTOSIS		3.11	KURTOSIS		4.85
NUMBER OF SUBJECTS		119	NUMBER OF SUBJECTS		111
PERCENTILES			PERCENTILES		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
13.97	1 ST	0.55	18.03	1 ST	0.71
17.02	5 TH	0.67	20.07	5 TH	0.79
18.03	10 TH	0.71	21.08	10 TH	0.83
20.07	25 TH	0.79	23.11	25 TH	0.91
22.10	50 TH	0.87	24.89	50 TH	0.98
23.88	75 TH	0.94	27.94	75 TH	1.10
25.91	90 TH	1.02	29.97	90 TH	1.18
26.92	95 TH	1.06	29.99	95 TH	1.20
28.96	99 TH	1.14	38.10	99 TH	1.50

MIDNASALE BRIDGE HEIGHT FROM MAXILLONASALE PLANE LINE: A perpendicular projection distance of the MIDNASALE landmark away from a line coincident with the right and left MAXILLONASALE landmarks.

TABLE 20. PRONASALE HEIGHT FROM MAXILLOALARE PLANE LINE

FEMALE			MALE		
SUMMARY STATISTICS			SUMMARY STATISTICS		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
32.02	MEAN	1.26	37.12	MEAN	1.46
0.28	STD ERROR (MEAN)	0.01	0.34	STD ERROR (MEAN)	0.01
3.10	STD DEVIATION	0.12	3.61	STD DEVIATION	0.14
23.11	MINIMUM	0.91	26.92	MINIMUM	1.06
39.88	MAXIMUM	1.58	45.97	MAXIMUM	1.81
COEFF. OF VARIATION (%)		9.55	COEFF. OF VARIATION (%)		9.76
SYMMETRY		0.07	SYMMETRY		-0.36
KURTOSIS		3.59	KURTOSIS		3.26
NUMBER OF SUBJECTS		120	NUMBER OF SUBJECTS		111
PERCENTILES			PERCENTILES		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
23.11	1 ST	0.91	26.92	1 ST	1.06
26.92	5 TH	1.06	29.97	5 TH	1.18
27.94	10 TH	1.10	33.02	10 TH	1.30
29.97	25 TH	1.12	35.05	25 TH	1.38
32.02	50 TH	1.26	37.01	50 TH	1.46
34.04	75 TH	1.34	39.08	75 TH	1.57
36.07	90 TH	1.42	40.89	90 TH	1.61
37.08	95 TH	1.46	42.93	95 TH	1.69
39.12	99 TH	1.54	44.96	99 TH	1.77

PRONASALE HEIGHT FROM MAXILLOALARE PLANE LINE: A perpendicular projection distance of the PRONASALE landmark away from a line coincident with both bilateral MAXILLOALARE landmarks.

TABLE 21. PRONASALE HEIGHT FROM SELLION-PROMENTALE PLANE LINE

FEMALE			MALE		
SUMMARY STATISTICS			SUMMARY STATISTICS		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
24.83	MEAN	0.98	27.52	MEAN	1.09
0.25	STD ERROR(MEAN)	0.01	0.34	STD ERROR(MEAN)	0.34
2.95	STD DEVIATION	0.12	3.62	STD DEVIATION	3.62
19.05	MINIMUM	0.75	16.00	MINIMUM	0.63
39.12	MAXIMUM	1.54	35.05	MAXIMUM	1.38
COEFF. OF VARIATION(%)		11.99	COEFF. OF VARIATION(%)		13.05
SYMMETRY		0.91	SYMMETRY		-0.03
KURTOSIS		5.57	KURTOSIS		2.92
NUMBER OF SUBJECTS		144	NUMBER OF SUBJECTS		114
PERCENTILES			PERCENTILES		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
19.05	1 ST	0.75	16.00	1 ST	0.63
20.08	5 TH	0.82	22.10	5 TH	0.87
21.08	10 TH	0.83	23.11	10 TH	0.91
23.11	25 TH	0.91	24.89	25 TH	0.98
24.89	50 TH	0.98	26.92	50 TH	1.06
25.91	75 TH	1.02	29.97	75 TH	1.18
28.96	90 TH	1.14	32.00	90 TH	1.26
29.97	95 TH	1.18	34.04	95 TH	1.34
33.02	99 TH	1.30	35.05	99 TH	1.38

PRONASALE HEIGHT FROM SELLION-PROMENTALE PLANE LINE: The perpendicular projection distance of PRONASALE away from a midsagittal line coincident with the SELLION and PROMENTALE landmarks.

TABLE 22. SELLION HEIGHT FROM MEDIAL CANTHUS PLANE LINE

FEMALE			MALE		
SUMMARY STATISTICS			SUMMARY STATISTICS		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
11.42	MEAN	0.45	12.87	MEAN	0.51
0.28	STD ERROR(MEAN)	0.02	0.31	STD ERROR(MEAN)	0.31
3.13	STD DEVIATION	0.12	3.21	STD DEVIATION	0.13
6.10	MINIMUM	0.24	7.00	MINIMUM	0.28
22.10	MAXIMUM	0.87	26.00	MAXIMUM	1.02
COEFF. OF VARIATION(%)		27.11	COEFF. OF VARIATION(%)		24.85
SYMMETRY		0.48	SYMMETRY		0.88
KURTOSIS		3.37	KURTOSIS		4.93
NUMBER OF SUBJECTS		121	NUMBER OF SUBJECTS		111
PERCENTILES			PERCENTILES		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
6.10	1 ST	0.24	7.01	1 ST	0.28
7.11	5 TH	0.28	8.00	5 TH	0.31
7.87	10 TH	0.31	8.99	10 TH	0.35
8.89	25 TH	0.35	11.00	25 TH	0.43
10.92	50 TH	0.43	13.00	50 TH	0.51
13.97	75 TH	0.55	14.00	75 TH	0.55
14.99	90 TH	0.59	16.99	90 TH	0.67
16.00	95 TH	0.63	18.01	95 TH	0.71
20.07	99 TH	0.79	23.01	99 TH	0.91

SELLION HEIGHT FROM MEDIAL CANTHUS PLANE LINE: A perpendicular projection distance of the SELLION landmark away from a line coincident with both bilateral areas just medial of the ENTOCANTHION landmarks.

TABLE 23. SELLION HEIGHT FROM LATERAL ORBITAL PLANE LINE

FEMALE			MALE		
SUMMARY STATISTICS			SUMMARY STATISTICS		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
29.56	MEAN	1.17	32.99	MEAN	1.30
0.50	STD ERROR (MEAN)	0.01	0.56	STD ERROR (MEAN)	0.02
3.80	STD DEVIATION	0.15	3.44	STD DEVIATION	0.13
21.08	MINIMUM	0.83	26.92	MINIMUM	1.06
39.12	MAXIMUM	1.54	38.10	MAXIMUM	1.50
COEFF. OF VARIATION (%)		12.55	COEFF. OF VARIATION (%)		10.14
SYMMETRY		0.42	SYMMETRY		-0.14
KURTOSIS		3.07	KURTOSIS		1.77
NUMBER OF SUBJECTS		58	NUMBER OF SUBJECTS		38
PERCENTILES			PERCENTILES		
MILLIMETERS		INCHES	MILLIMETERS		INCHES
20.83	1 ST	0.82	26.92	1 ST	1.06
23.88	5 TH	0.94	27.94	5 TH	1.10
24.89	10 TH	0.98	28.45	10 TH	1.12
27.43	25 TH	1.08	29.97	25 TH	1.18
28.96	50 TH	1.14	34.04	50 TH	1.34
32.00	75 TH	1.26	35.05	75 TH	1.38
35.05	90 TH	1.38	37.08	90 TH	1.46
36.07	95 TH	1.42	37.59	95 TH	1.48
39.12	99 TH	1.54	38.10	99 TH	1.50

SELLION HEIGHT FROM LATERAL ORBITAL PLANE LINE: A perpendicular projection distance of the SELLION landmark away from a line coincident with the antero-lateral aspects of the lateral orbital rims, just lateral of the right and left ECTOCANTHION landmarks.